


What is claimed is:

1. A non-aqueous secondary battery comprising positive and negative electrodes and a lithium salt-containing electrolyte, the battery being at least 30Wh in energy capacity and at least 180Wh/l in volume energy density and having a flat shape with a thickness of less than 12 mm.
2. The non-aqueous secondary battery according to claim 1, wherein the positive electrode contains manganese oxide.
3. The non-aqueous secondary battery according to claim 1 or 2, wherein the negative electrode is formed by using graphite having an average particle diameter of 1 to 50 mm as active material, a resin as binder, and a metal as current collector, the negative electrode having a porosity of 20 to 35%, an electrode density of 1.40 to 1.70 g/cm³, and an capacity of electrode of 400 Ah/cm³ or higher.
4. The non-aqueous secondary battery according to claim 3, wherein the negative electrode contains a graphite material obtained by graphitizing mesocarbon microbeads.
5. The non-aqueous secondary battery according to claim 1 or 2, wherein the negative electrode comprises as active material double-structure graphite particles formed with graphite-based particles and amorphous carbon layers covering the surface of the graphite-based particles, the graphite-based particles having (d002) spacing of (002) planes of not more than 0.34 nm as measured by X-ray wide-angle diffraction method, the amorphous carbon layers having (d002) spacing of (002) planes of 0.34 nm or higher.
6. The non-aqueous secondary battery according to claim 5, wherein the negative electrode is formed by using double-structure graphite particles having an average

particle diameter of 1 to 50 mm as active material, a resin as binder, and a metal as current collector, the negative electorode having a porosity of 20 to 35%, an electrode density of 1.20 to 1.60 g/cm³, and an capacity of electrode of 400 mAh/cm³ or higher.

7. The non-aqueous secondary battery according to claim 1 or 2, wherein the negative electrode comprises as active material a carbon material manufactured by mixing at least one of artificial graphite and natural graphite with a carbon material having volatile components on the surface and/or in the inside and baking the mixture.

 8. The non-aqueous secondary battery according to claim 7, wherein the negative electrode is formed by using a resin as binder and a metal as current collector, the negative electrode having a porosity of 20 to 35%, an electrode density of 1.20 to 1.60 g/cm³, and an capacity of electrode of 400 mAh/cm³ or higher.

9. The non-aqueous secondary battery according to claim 1, wherein the front and rear sides of the flat shape are rectangular.

10. The non-aqueous secondary battery according to claim 1, wherein the wall thickness of a battery case of the non-aqueous secondary battery is not less than 0.2 mm and not more than 1 mm.

11. A secondary battery comprising a positive electrode, a negative electrode, a separator, and a non-aqueous electrolyte containing lithium salt and having a flat shape.

12. The non-aqueous secondary battery according to claim 11, wherein

when a pressure of 2.5 kg/cm^2 is applied to the direction of thickness of the separator, the thickness A of the separator is not less than 0.02 mm and not more than 0.15 mm and the porosity of the separator is 40% or higher, and

when the absolute value of a change rate of the thickness (mm) of the separator relative to the pressure (kg/cm^2) applied to the direction of thickness of the separator is defined as B ($\text{mm}/(\text{kg/cm}^2)$), the pressure F which renders $B/A=1$ is not less than 0.05 kg/cm^2 and not more than 1 kg/cm^2 .

13. The non-aqueous secondary battery according to claim 11, wherein

the separator has a first separator and a second separator different from the first separator,

when a pressure of 2.5 kg/cm^2 is applied to the direction of thickness of the separator, the thickness A of the first separator is not less than 0.02 mm and not more than 0.15 mm and the porosity of the first separator is 40% or higher, and

when the absolute value of a change rate of the thickness (mm) of the first separator relative to the pressure (kg/cm^2) applied to the direction of thickness of the first separator is defined as B ($\text{mm}/(\text{kg/cm}^2)$), the pressure F which renders $B/A=1$ is not less than 0.05 kg/cm^2 and not more than 1 kg/cm^2 , and

the second separator is a micro-porous film having a thickness of 0.05 mm or less, a pore diameter of 5 mm or less, and a porosity of 25% or more.

14. The non-aqueous secondary battery according to claim 11, wherein

the separator is bonded with the positive electrode and/or the negative electrode.

15. The non-aqueous secondary battery according to claim 14, wherein the separator is bonded with the positive electrode and the negative electrode by fusing part of the separator and, passages for the non-aqueous electrolyte are formed to penetrate the separator from the front side surface to the rear side surface thereof.

16. The non-aqueous secondary battery according to any one of claims 12 to 15, wherein the non-aqueous secondary battery has a flat shape with a thickness of less than 12 mm and is at least 30Wh in energy capacity and at least 180 Wh/l in volume energy density.

17. The non-aqueous secondary battery according to any one of claims 12 to 16, wherein the front side and the rear side of the flat shape are rectangular.

18. The non-aqueous secondary battery according to any one of claims 12 to 16, wherein the wall thickness of a battery case of the non-aqueous secondary battery is not less than 0.2 and not more than 1 mm.

19. The non-aqueous secondary battery according to any one of claims 12 to 15, wherein the separator is made of a material comprising at least one of polyethylene or polypropylene as a main component.

20. The non-aqueous secondary battery according to claim 12, wherein the separator is made of non-woven fabric.

21. The non-aqueous secondary battery according to claim 20, wherein the unit weight of the separator is not less than 5 and g/m^2 and not more than 30 g/m^2 .

22. The non-aqueous secondary battery according to claim 13, wherein the first separator is made of non-woven fabric.

23. The non-aqueous secondary battery according to claim 22,, wherein the unit weight of the first separator is not less than 5 and g/m^2 and not more than 30 g/m^2 .

24. The non-aqueous secondary battery according to claim 13, wherein the first and second separators are joined together integrally.

25. The non-aqueous secondary battery according to claim 13, wherein the material of the first separator is different from that of the second separator.

26. The non-aqueous secondary battery according to claim 13, wherein at least one of the first and second separators contain polyethylene.

27. A secondary-battery control method to be applied to the secondary battery of claim 1 or 11, comprising the steps of measuring operational parameters of at different portions of the battery and controlling operations of the battery based on the results of the measurement.

28. The secondary-battery control method according to claim 27,, wherein the operational parameters to be measured include at least one of the voltage, tension of current, temperature, dimensions, and internal resistance of a secondary battery.

29. The secondary-battery control method according to claim 27, wherein charge and discharge conditions and resting conditions of the battery, battery temperatures adjusted by heating or cooling, and pressure against the battery case are controlled based on the results of the measurement.

P. 1
30. A secondary battery for a energy storage system, comprising positive and negative terminals for charge and discharge provided on the battery case and operation-parameter measuring electrodes extending from different portions of the battery to the outside of the battery case for measurement of the operation parameters in the battery.